

AC Resistance & Inductive Reactance

Dimensions and weights are nominal; subject to standard industry tolerances.

AC Resistance ohms/km (at operating temperature)

CONDUCTOR SIZE AWG OR kcmil	SINGLE STRANDED CONDUCTOR*					3 CONDUCTOR CABLE** FACTOR	
	COPPER			ALUMINUM (ACM)		CU	AL
	60°C	75°C	90°C	75°C	90°C		
14	9.7550	10.2630	10.7550	—	—	1.00	—
12	6.1480	6.4660	6.7780	10.6730	11.1880	1.00	1.00
10	3.8680	4.0690	4.2650	6.7010	7.0240	1.00	1.00
8	2.4320	2.5580	2.6810	4.2130	4.4160	1.00	1.00
6	1.5300	1.6090	1.6870	2.6520	2.7800	1.00	1.00
4	.9614	1.0110	1.0600	1.6670	1.7470	1.00	1.00
3	.7630	.8025	.8412	1.3210	1.3850	1.00	1.00
2	.6055	.6369	.6676	1.0480	1.0990	1.01	1.00
1	.4797	.5046	.5289	.8313	.8714	1.01	1.00
1/0	.3803	.4000	.4193	.6591	.6909	1.02	1.00
2/0	.3018	.3174	.3327	.5234	.5486	1.03	1.00
3/0	.2393	.2517	.2638	.4154	.4354	1.04	1.01
4/0	.1898	.1997	.2093	.3292	.3451	1.05	1.01
250	.1613	.1696	.1778	.2789	.2923	1.06	1.02
300	.1346	.1416	.1485	.2325	.2439	1.06	1.02
350	.1157	.1217	.1276	.1997	.2093	1.07	1.03
400	.1015	.1068	.1119	.1748	.1833	1.09	1.03
500	.0818	.0861	.0902	.1402	.1470	1.11	1.05
600	.0677	.0712	.0746	.1171	.1227	1.13	1.07
750	.0557	.0586	.0614	.0943	.0988	1.16	1.10
1000	.0428	.0450	.0472	.0716	.0750	—	1.16

*Except for the most critical cases these values may be used for 2 or 3 conductors in non-metallic or aluminum conduit.

**Multiply the single conductor values by these Factors to determine the AC Resistance of 3 conductor cable.

Impedance (Z , ohms/km) is obtained using the following formula: $Z = \sqrt{R^2 + XL^2}$ (neglecting capacitance).

R = AC Resistance ohm/km

Multiply ohms/km by 0.3048 to obtain ohms/1000 ft

Inductive Reactance ohms/km (at 60 hertz) 600 Volt & 1000 Volt

CONDUCTOR SIZE AWG OR kcmil	VOLTAGE VOLTS	3 SINGLE CABLES			IN ALUMINUM CONDUIT*	3 CONDUCTOR CABLE ALUMINUM ARMOR*	
		ONE CABLE DIAMETER SPACING			(A) B C	(A) (B) (C)	(A) (B) (C)
		RW90	RA90	TECK90			
14	600	—	—	—	.1480	.1230	.1230
12	600	—	—	—	.1395	.1160	.1155
10	600	—	—	—	.1315	.1095	.1090
8	1000	—	—	—	.1455	.1225	.1145
6	1000	—	—	—	.1370	.1140	.1175
4	1000	—	—	—	.1290	.1075	.1105
3	1000	—	—	—	.1255	.1045	.1070
2	1000	—	—	—	.1230	.1025	.1045
1	1000	—	—	—	.1280	.1065	.1060
1/0	1000	.1695	.2040	.2190	.1200	.1000	.1020
2/0	1000	.1660	.2010	.2140	.1165	.0970	.0995
3/0	1000	.1650	.1970	.2130	.1135	.0945	.0965
4/0	1000	.1630	.1960	.2080	.1110	.0925	.0945
250	1000	.1620	.1925	.2085	.1105	.0920	.0950
300	1000	.1600	.1895	.2045	.1085	.0905	.0930
350	1000	.1595	.1875	.2010	.1070	.0895	.0915
400	1000	.1570	.1875	.1990	.1055	.0880	.0910
500	1000	.1565	.1865	.1955	.1035	.0865	.0890
600	1000	.1550	.1820	.1950	.1015	.0845	.0910
750	1000	.1535	.1800	.1915	.1000	.0835	.0900
1000	1000	.1520	.1770	.1875	.0985	.0820	.0880

Note: Values shown are based on nominal cable dimensions which are influenced by changes in materials and conductor design. Except for the most critical cases such variations are of little consequence. Formula $XL = 0.17362 \log_{10} \frac{GMD}{GMR}$ ohms/km. XL = Inductive reactance ohms/km, GMD = Geometric mean distance between conductors, GMR = Geometric mean radius of conductors.

For 3 conductors in steel conduit or steel armor multiply table values by 1.25.

Multiply ohms/km by 0.3048 to obtain ohms/1000 ft Dimensions and weights are nominal; subject to industry tolerance.



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AC Resistance & Inductive Reactance

Inductive Reactance ohms/km (at 60 hertz) 5kV – TECK90 and HVTECK (Aluminum Armored)

CONDUCTOR SIZE AWG OR kcmil	SINGLE CONDUCTOR ONE CABLE DIAMETER SPACING			3 CONDUCTOR*		
	A	B	C	HVTECK SHIELDED		3 CONDUCTOR*
				5KV (100%)	5KV (133%)	TECK 90 5KV UNSHIELDED
6	.2630	.2770	.2810	.1385	.1495	.1660
4	.2530	.2630	.2710	.1290	.1400	.1490
2	.2400	.2540	.2600	.1205	.1305	.1390
1	.2310	.2440	.2500	.1145	.1220	.1310
1/0	.2240	.2330	.2440	.1100	.1185	.1270
2/0	.2225	.2270	.2370	.1065	.1150	.1220
3/0	.2165	.2205	.2310	.1030	.1100	.1180
4/0	.2130	.2170	.2250	.1010	.1075	.1150
250	.2110	.2150	.2220	.1000	.1060	.1120
300	.2075	.2110	.2170	.0980	.1038	.1090
350	.2040	.2075	.2140	.0960	.1020	.1070
400	.2010	.2045	.2110	.0950	.1010	.1050
500	.1980	.2015	.2090	.0925	.0980	.1040
600	.1970	.2000	.2030	.0945	.1010	.1060
750	.1935	.1975	.2010	.0935	.0990	.0980
1000	.1895	.1920	.1960	.0910	.0955	.0950

Note: Values shown are based on nominal cable dimensions which are influenced by changes in materials and conductor design. Except for the most critical cases such variations are of little consequence.

Formula $XL = 0.17362 \log_{10} \frac{GMD}{GMR}$ ohms/km XL = Inductive reactance ohms/km GMD = Geometric mean distance between conductors.

GMR = Geometric mean radius of conductors.

*For steel armor multiply table values by 1.25.

Multiply ohms/km by 0.3048 to obtain ohms/1000 ft

Inductive Reactance ohms/km (at 60 hertz) 15kV, 25 & 28kV - HVTECK (Aluminum Armored)

CONDUCTOR SIZE AWG OR kcmil	3 CONDUCTOR*					
	15 KV (100%)	15 KV (133%)	25 KV (100%)	25 KV (133%)	28 KV (100%)	28 KV (133%)
2	.1510	-	-	-	-	-
1	.1425	.1500	.1575	.1700	.1605	.1725
1/0	.1365	.1435	.1510	.1640	.1540	.1665
2/0	.1315	.1385	.1455	.1580	.1485	.1605
3/0	.1265	.1330	.1405	.1510	.1440	.1540
4/0	.1225	.1285	.1360	.1465	.1385	.1490
250	.1205	.1275	.1335	.1430	.1360	.1450
300	.1170	.1235	.1290	.1390	.1320	.1410
350	.1155	.1205	.1260	.1350	.1290	.1370
400	.1140	.1190	.1240	.1325	.1270	.1350
500	.1105	.1150	.1200	-	.1220	-
600	.1100	.1155	.1205	-	-	-
750	.1080	.1120	-	-	-	-
1000	.1045	-	-	-	-	-

Note: Values shown are based on nominal cable dimensions which are influenced by changes in materials and conductor design. Except for the most critical cases such variations are of little consequence.

Formula $XL = 0.17362 \log_{10} \frac{GMD}{GMR}$ ohms/km XL = Inductive reactance ohms/km GMD = Geometric mean distance between conductors.

GMR = Geometric mean radius of conductors.

*For steel armor multiply table values by 1.25. Multiply ohms/km by 0.3048 to obtain ohms/1000 ft. Dimensions and weights are nominal; subject to industry tolerance.



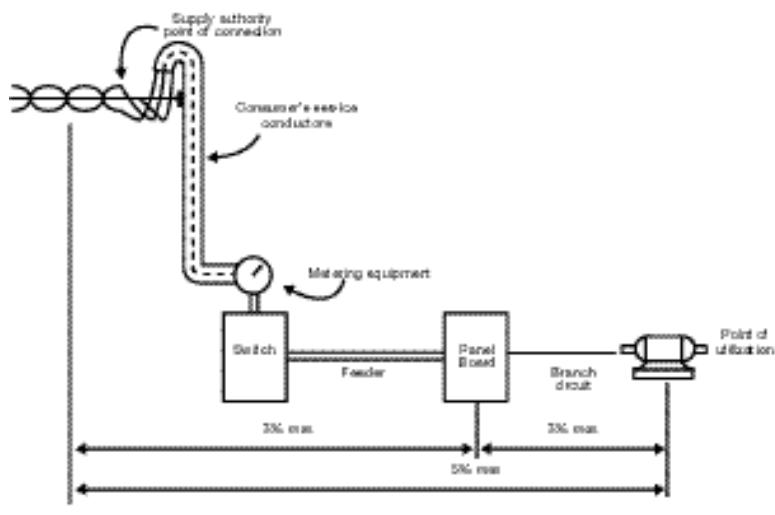
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Voltage Drop

Explanation

The Canadian Electrical Code (Rule 8-102) permits a 3% voltage drop in a "feeder" or "branch circuit" and no more than 5% voltage drop from the supply side of the consumer's service to the point of utilization.

FIGURE 4 – Voltage Drop Schematic



The next two tables (Tables A & B) on Page 181 can be used to determine the size of conductor required when installed over a given distance and operating at a given amperage, in order that the voltage drop will be 3%. (To calculate 5% voltage drop, multiply the calculated amperes-meters value by $3/5 = 0.60$). To avoid possible overcurrent damage, a maximum of 3% voltage drop is recommended for motor feeders.

It is important to note that voltage drop is also influenced by factors such as operating temperature, power factor and conductor spacing. For voltage drop information for types and methods of installation not shown in Tables A & B, consult General Cable Customer Service.

How to Use Voltage Drop Tables

Before attempting to use the tables, the following information is required:

Check List:

- System – Single or Three-Phase
- Operating Voltage – Volts
- Conductor Material – Copper, Aluminum
- Demand Load – Amperes
- Circuit Length – Meters
- Cable Configuration
- Permissible Voltage Drop – 3% or 5%

Parameters used for Tables A & B:

- Cable – RW90 1000 Volt
- Operating Temperature 75°C
- Ambient Temperature 30°C
- Power Factor 0.9 Lagging
- Inductance Included

Voltage Drop

Example Calculations:

A. It is required to supply a three-phase 600 Volt 200 ampere load with single RW90 copper conductors spaced horizontally (1 cable diameter apart). The run is 80 meters. The voltage drop must not exceed 3%.

Steps:

1. Referring to the Canadian Electrical Code (CEC) ampacity table for RW90 in free air it is noted that a #1 AWG copper cable will satisfy the 200 ampere load requirement, $200 \text{ amperes} \times 80 \text{ meters} = 16000 \text{ ampere-meters}$.
2. 600 Volt 1 AWG copper cable will satisfy an ampere-meter value of 18120, therefore a 1 AWG copper cable satisfies both load and voltage drop requirements.

B. It is required to supply a single phase 120 Volt 30 ampere load using two single RW90 copper conductors in aluminum conduit or 2 conductor AC90 cable. The run is 25 meters. The voltage drop must not exceed 3%.

Steps:

1. Referring to the CEC ampacity table for RW90, or AC90, it is noted that 2 conductor 10 AWG copper cable will satisfy the 30 ampere load requirement, $30 \text{ amperes} \times 25 \text{ meters} = 750 \text{ ampere-meters}$.
 2. Referring to Table B on the next page for 120 Volt copper, it is noted that the maximum ampere-meters for 10 AWG copper is 489, therefore in order to satisfy the 750 ampere-meter requirement, a 8 AWG copper cable is necessary if the voltage drop requirement is to be met.
- C. If the system voltage and/or voltage drop are different than those shown in the tables, adjust the calculated ampere-meters by the factors shown in the footnotes to the tables.

Examples:

Using 1000 ampere-meters as a base:

If 5% voltage drop, it becomes $1000 \times 0.6 = 600 \text{ ampere-meters}$

If 240 volt system, it becomes $1000 \times 0.5 = 500 \text{ ampere-meters}$

For both 5% voltage drop and 240 volt system, the calculation becomes $1000 \times 0.6 \times 0.5 = 300 \text{ ampere-meters}$.

D. Long runs of spaced single conductor cable often necessitates an increase in conductor size in order to meet the voltage drop requirements.

This is caused by the high impedance of spaced conductor circuits. In such cases multi-conductor circuits should be considered.

A comparison of Table A with Table B on the next page for any given size of conductor illustrates the benefit of using multi-conductors in conduit or cable particularly in the larger size conductors.

Example:

In a 600 volt three-phase circuit, for 395 amperes and 215 meters (84,925 ampere-meters), using spaced single conductor, 1000 kcmil copper cable is required at 3% voltage drop, (Ref Table A, 600 Volt Copper).

Alternatively, if a three conductor cable is employed the load and voltage drop requirements are satisfied using 500 kcmil copper cable, (Ref Table B, 600 Volt Copper).



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Voltage Drop

**Table A - Allowable Ampere-Meters (Max.) for 3% Voltage Drop (line-to-line)
Single Conductor Cable***

CONDUCTOR SIZE AWG OR kcmil	120 VOLT SINGLE PHASE		600 VOLT THREE PHASE	
	COPPER	ALUMINUM	COPPER	ALUMINUM
2	2511	1716	14595	9909
1	3177	2076	18120	11976
1/0	3858	2553	21861	14754
2/0	4575	3138	26469	18120
3/0	5745	3900	33129	22500
4/0	6390	4575	36834	26472
250	7347	5487	42252	31689
350	9153	6879	52836	39702
500	11250	8457	64749	49092
600	12273	9642	70497	55608
750	13845	10800	79647	62463
1000	15000	12855	85851	73773

*Including non-armored cable, non-magnetic armor, or single conductor in non-magnetic conduit.

d = cable diameter

Notes:

1. For voltage drop of 5%, multiply the calculated ampere-meter value by 0.6, then use Table A.
2. For 240 Volt single phase system, multiply the calculated ampere-meter value by 0.5, then use 120 volt copper or aluminum value from Table A.
3. For 208 Volt three-phase system, multiply the calculated ampere-meter value by 2.88, then use 600 volt copper or aluminum from Table A.
4. Multiply Ampere-Meters by 3.2808 to obtain Ampere-Feet.

**Table B - Allowable Ampere-Meters (Max.) for 3% Voltage Drop (line to line)
3 Conductor Cable***

CONDUCTOR SIZE AWG OR kcmil	120 VOLT SINGLE PHASE		600 VOLT THREE PHASE	
	COPPER	ALUMINUM	COPPER	ALUMINUM
14	198	-	1152	-
12	315	183	1812	1053
10	489	294	2814	1689
8	783	441	4539	2556
6	1227	732	7014	4224
4	1952	1167	11490	6750
2	3087	1830	17418	10587
1	3723	2286	20769	13236
1/0	4500	2895	25713	16716
2/0	5685	3387	31764	19635
3/0	7200	4236	38541	24546
4/0	8307	5487	45000	31689
250	11880	6102	54000	35526
350	12273	8121	67500	46632
500	15882	10800	90000	62427
600	17418	12204	10800	70494
750	19287	14457	112500	83463
1000	22041	17169	128571	99081

*Including non-armored cable, non-magnetic armor, or 3 conductors in non-magnetic conduit.

Notes:

1. For Voltage drop of 5%, multiply the calculated ampere-meter value by 0.6, then use Table B.
2. For 240 Volt single phase system, multiply the calculated ampere-meter value by 0.5, then use 120 Volt copper or aluminum value from Table B.
3. For 208 Volt three-phase system, multiply the calculated ampere-meter value by 2.88, then use 600 Volt copper or aluminum value from Table B.
4. Multiply Ampere-Meters by 3.2808 to obtain Ampere-Feet. Dimensions and weights are nominal; subject to industry tolerance.



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Emergency Overload Current

Formula

The increase or decrease of the load current is not associated with an instantaneous change of the cable temperature. Hence, during emergency conditions, the cable may be overloaded for short periods of time at the maximum overload temperature of 130°C for XLPE and 130°C/140°C for EPR rated at 90°C/105°C continuous.

Operations at the emergency overload temperature shall not exceed 100 hours in any twelve consecutive months or more than 500 hours during the lifetime of the cable. Lower temperature for emergency overload conditions may be required due to the type of material used in the cable splices and terminations or environmental conditions.

The following formula shows the approximate relationship between the overload period, the overload current and the overload temperature.

$$t = K \log_e \left\{ \frac{T_o - T_{c_1}}{\left[\left(\frac{I_o}{I_c} \right)^2 (T_c - T_a) \right] - (T_u - T_c)} + 1 \right\}$$

Where:	t	=	Overload period, hours
	K	=	Thermal time constant (see table below)
	T_o	=	Conductor overload temperature, °C (max. 130°C or 140°C for MV-105)
	T_{c_1}	=	Conductor temperature at time overload current is applied, °C
	I_o	=	Current overload, amperes
	I_c	=	Conductor current at normal conductor temperature T_c and ambient temperature T_a , amperes
	T_c	=	Conductor normal operating temperature, °C (max. 90°C or 105°C for MV-105)
	T_a	=	Ambient temperature, °C

Thermal Time Constant K

This constant, which is a function of the conductor size and its surrounding environment, is defined as the time taken (in hours) by the conductor to achieve 63% of the total rise in temperature.

Approximate values of K for different conductor sizes are given in the table below for cables direct buried, in underground ducts and in air.

Conductor Size Single or Multi	Approximate Thermal Time Constant, k, (Hours)			
	Cable In Air	Cable In Aerial Conduit	Cable In Underground Duct	Directly Buried Or Submarine
Up to 2 AWG	.33	.67	1.00	1.25
2 to 4/0 AWG	1.00	1.50	2.50	3.00
250 MCM and Up	1.50	2.50	4.00	6.00

Dimensions and weights are nominal; subject to industry tolerance.



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Short Circuit Current

The maximum short circuit current which is permitted to flow in the insulated conductor, or the metallic shielding and bonding (grounding) components, is dependent on the duration of the short circuit and the material used in the cable.

Insulated Conductors Formula

The graphs on the following pages show the short circuit capability of 10 AWG to 1000 kcmil, copper and aluminum, XLPE and EPR insulated conductors for various periods of time. These graphs are in accordance with ICEA publication P-32-382. The equations are based on the assumption that the duration of the short circuit is so short that the heat generated is contained within the conductor, taking into consideration the temperature limit of the insulation.

The graphs are derived from the following formula:

$$\text{Copper Conductor } \left[\frac{I}{A} \right]^2 t = 0.0297 \log_{10} \left[\frac{T_2 + 234}{T_1 + 234} \right]$$

$$\text{Aluminum Conductor } \left[\frac{I}{A} \right]^2 t = 0.0125 \log_{10} \left[\frac{T_2 + 228}{T_1 + 228} \right]$$

Which simplify to:

$$\text{Copper Conductor } I = \frac{0.07195 A}{\sqrt{t}} \quad \text{amperes for MV-90}$$

$$\text{Copper Conductor } I = \frac{0.06773 A}{\sqrt{t}} \quad \text{amperes for MV-105}$$

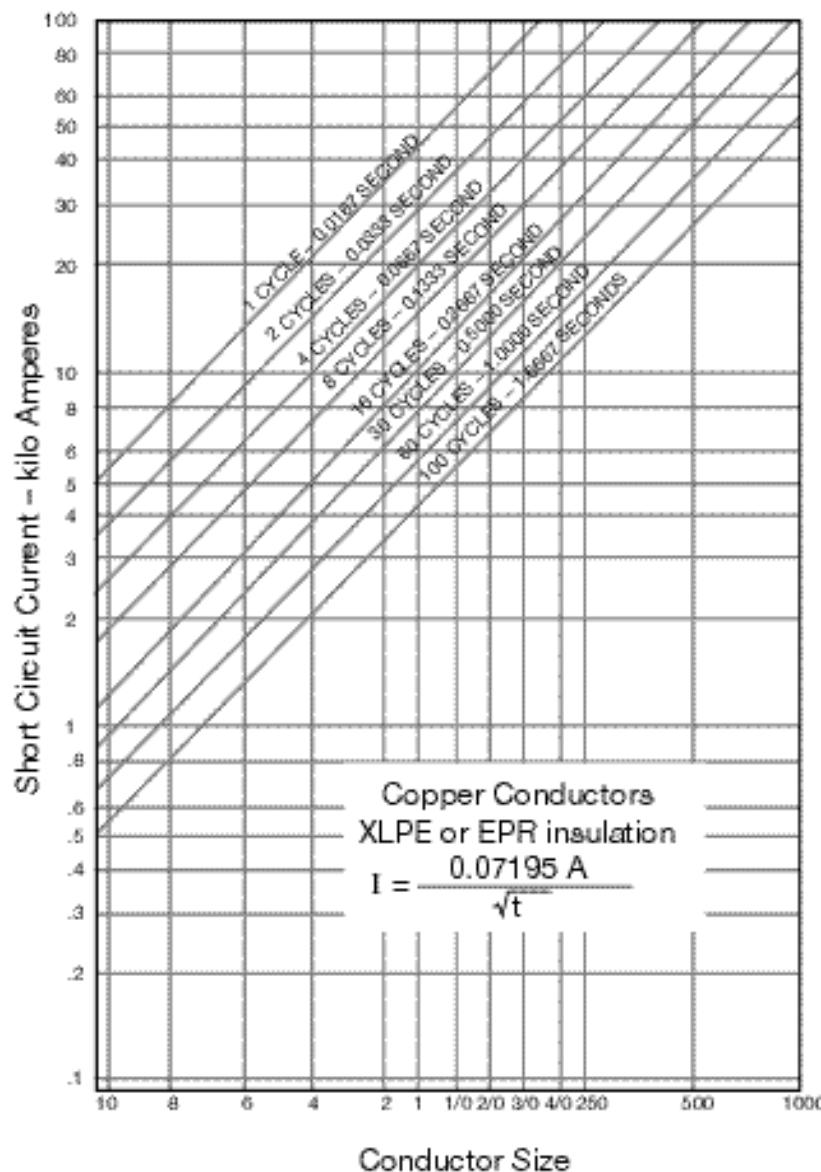
$$\text{Aluminum Conductor } I = \frac{0.0470 A}{\sqrt{t}} \quad \text{amperes for MV-90}$$

Where:
 I = Short circuit current (amperes)
 A = Conductor cross-sectional area (circular mils*)
 t = Short circuit duration (seconds)
 T₁ = Maximum normal operating temperature, 90°C for MV-90 or 105°C for MV-105
 T₂ = Maximum short circuit temperature, 250°C

*Refer to Conductor Table in this section for cross-sectional area.

Short Circuit Current

Allowable Short Circuit Currents for Insulated Copper Conductors Rated at 90°C



I = Current (amperes)

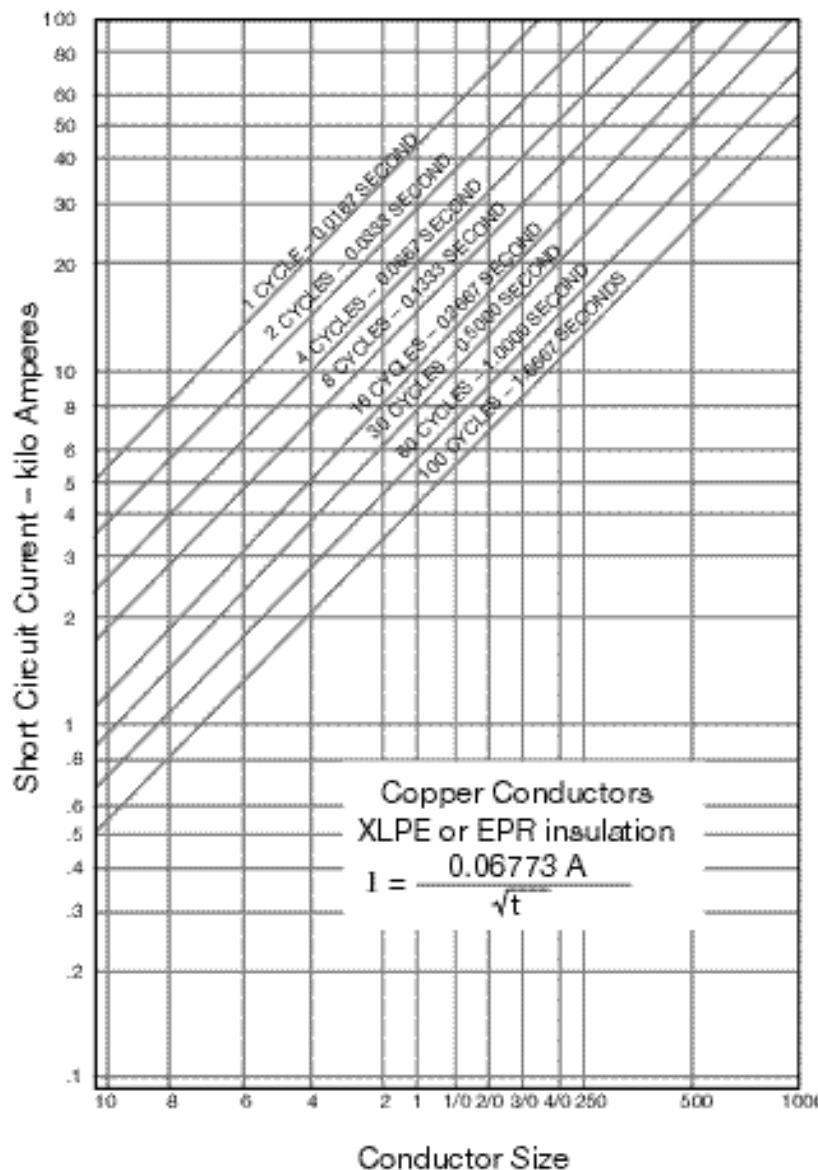
A = cross-sectional area of conductor (cmil)

t = Time (seconds)

Conductor temperature excursion during short circuit 105°C - 250°C

Short Circuit Current

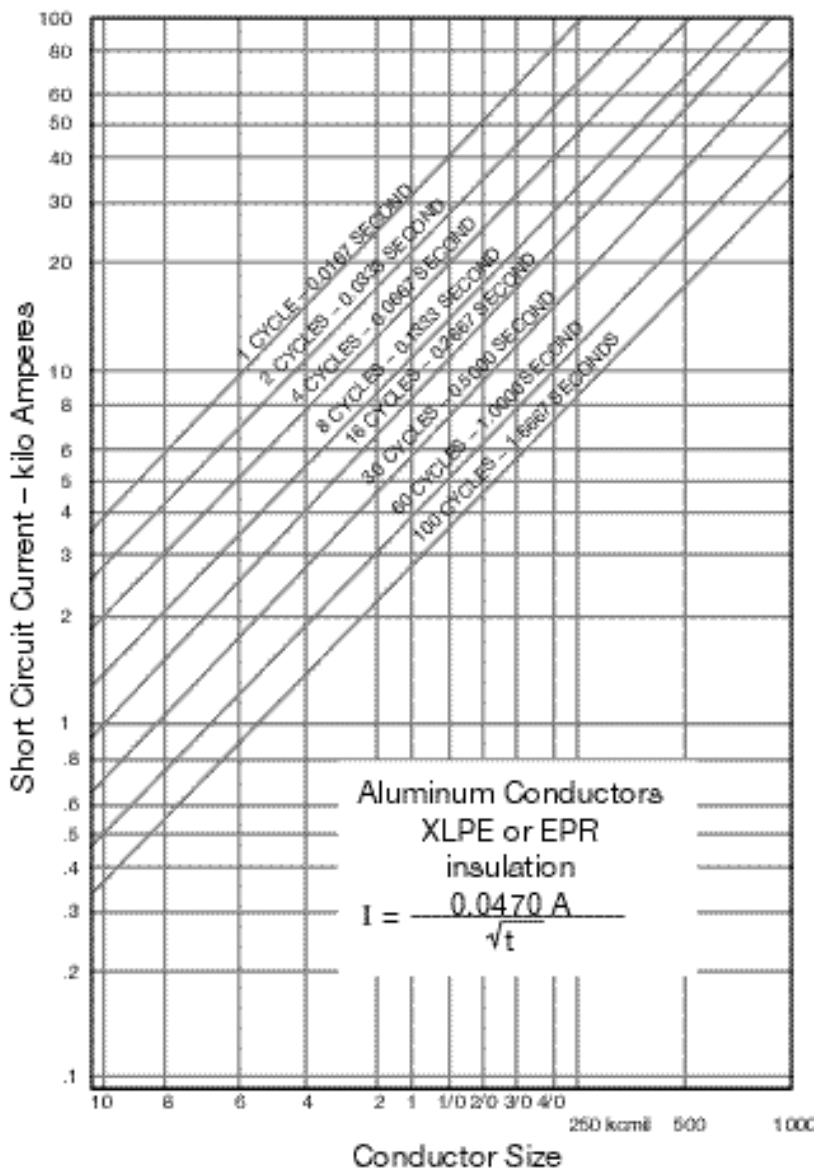
Allowable Short Circuit Currents for Insulated Copper Conductors Rated at 105°C



I = Current (amperes)
 A = Cross-sectional area of conductor (cmil)
 t = Time (seconds)
 Conductor temperature excursion during short circuit 105°C - 250°C

Short Circuit Current

Allowable Short Circuit Currents for Insulated Aluminum Conductors Rated at 90°C



I = Current (amperes)

A = Cross-sectional area of conductor (cmil)

t = Time (seconds)

Conductor temperature excursion during short circuit 105°C - 250°C

Formula - Copper Shield & Bonding (Grounding) Conductors

Formula—Copper Shield & Bonding (Grounding) Conductors

General Cable standard HVTECK cable contains an equipment bonding (grounding) conductor sized in accordance with the same CSA requirements as those applicable to the low-voltage TECK90 cables.

In the *single conductor* cables, the bonding (grounding) conductor, comprised of a helical serving of copper wires, is applied over the extruded semi-conducting insulation shield and also functions as the metallic component of the insulation shield.

In the *three conductor* cables, a copper tape is applied over each extruded semi-conducting insulation shield with a helical gap. Because the three copper tape shields are cabled in intimate contact with the bonding (grounding) conductor, their combined total cross-sectional areas may be considered an integral shielding system for the purpose of calculating short circuit capacity. It is not possible however, to determine the contact resistance between the components, due to possible oxides or film which may form on the components or movement of the cable core during handling. It may be advisable to consider the short circuit capacity of the individual shields independently. Because the insulation shields are in thermal contact with the inner PVC jacket, the maximum short circuit temperature T2 is 200°C and the normal operating temperature T1 is 85°C. Note that temperature T1 of 85°C is applicable to cables having voltage ratings up to and including 25kV. Refer to ICEA P-45-482, "Short Circuit Performance of Metallic Shields and Sheaths on Insulated Cable", for calculations involving cables that have other operating parameters.

Under these temperature conditions the short circuit current formula is: $I = \frac{0.063A}{\sqrt{ }} \text{ amperes}$

TYPE OF SHIELD OR SHEATH	FORMULA FOR CALCULATING A
1. Wires applied either helically, as a braid or serving; or longitudinally with corrugations - 1/C HVTECK	nd_s^2
2. Helically applied tape, not overlapped - 3/C HVTECK	1.27 nwb
3. Helically applied flat tape, overlapped See note 3	$4 bd_m : \sqrt{\frac{w}{L}}$
4. Corrugated tape, longitudinally applied	$1.27[\pi]dis+50+B]b$
5. Tubular sheath	$4 bd_m$

Meaning of Symbols:

- A = Effective cross-sectional area, shield or sheath
- B = Tape overlap (mils) (usually 375)
- b = Thickness of tape (mils)
- d_{is} = Diameter over semiconducting insulation shields (mils)
- d_m = Mean diameter of shield or sheath (mils)
- d_s = Diameter of wires (mils)
- I = Short circuit current (amperes)
- w = Width of tape (mils)
- n = Number of serving or braid wires or tapes
- L = Overlap of tape (percent)

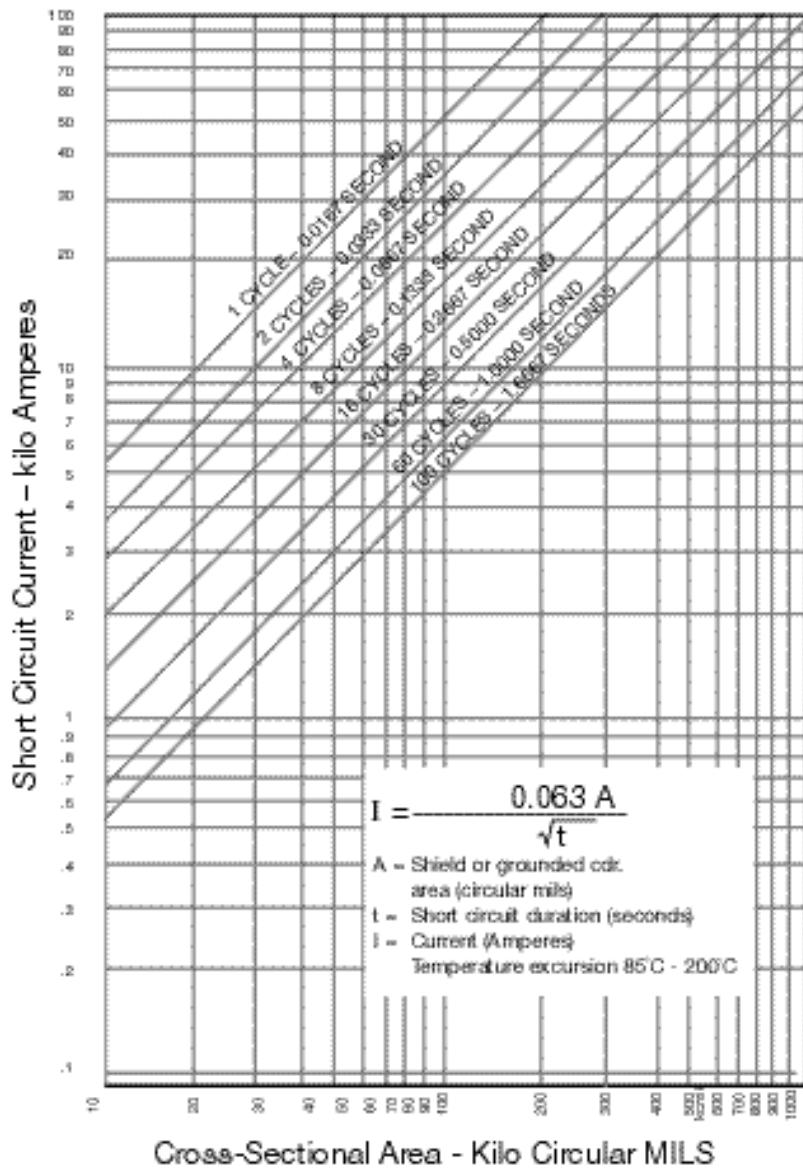
Notes:

1. The bonding (grounding) conductor size is shown in the TECK90 & HVTECK section of this catalog. For its circular mil area, see Table 1 in this section.
2. General Cable's standard copper shielding tape measures 750 mils (w) x 2.7 mils (b)
3. A graph for short circuit current of the shielding and bonding (grounding) components based on the above formula, is shown on the next page.

Dimensions and weights are nominal; subject to industry tolerance.

Formula - Copper Shield & Bonding (Grounding) Conductors

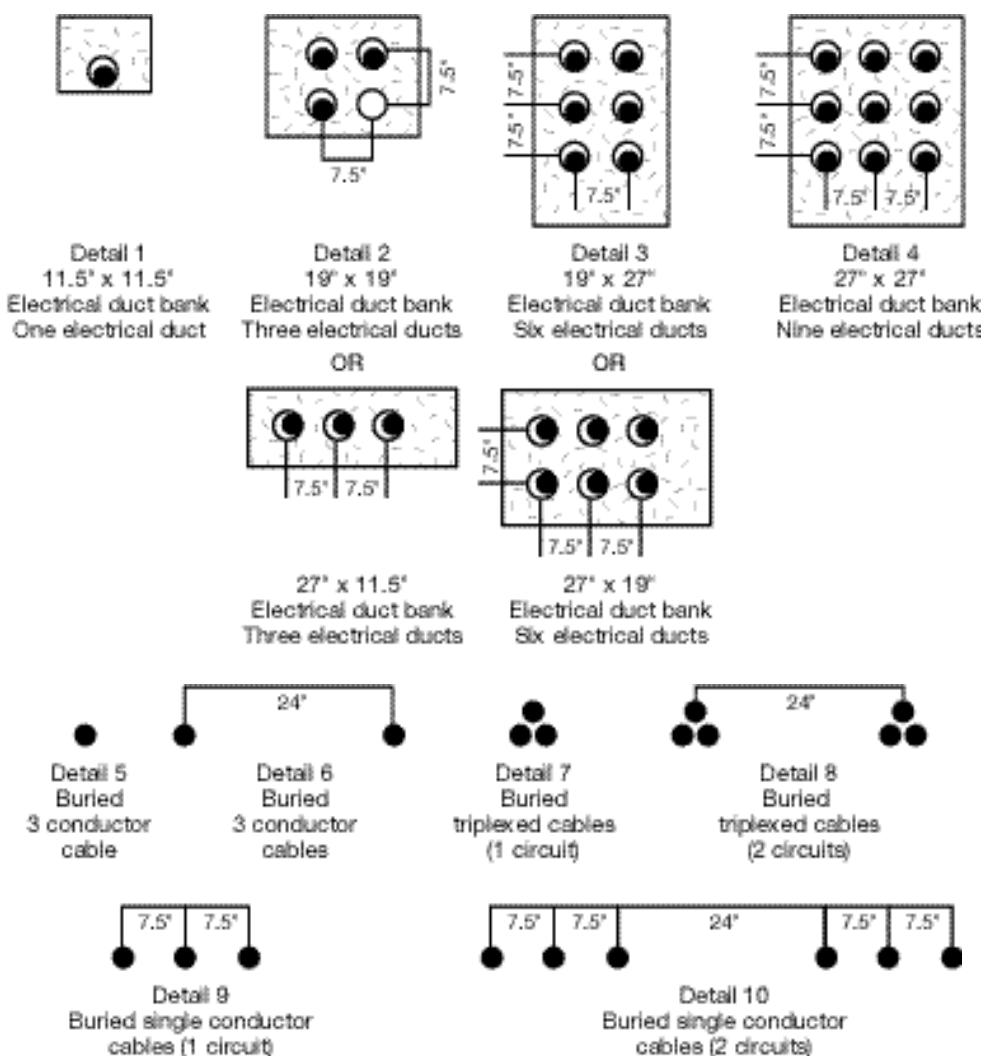
Allowable Short Circuit Currents for Copper Shield/Copper Bonding (Grounding) Conductor



Conductors for General Wiring

Article 310

Figure 310-1. Cable Installation Dimensions for Use with Tables 310-77 through 310-84.



Notes for all details:

1. Minimum burial depths to top electrical ducts or cables shall be in accordance with Section 300-5. Maximum depth to the top of electrical duct banks shall be 30 inches and maximum depth to top of direct buried cables shall be 36 inches.

2. Burial depths shall be permitted to be increased in part(s) of the duct run to avoid underground obstructions without decreasing the rated ampacity of the conductors. The total length of parts of the duct run increased in depth to avoid obstructions, must be less than 25 percent of the total run length, or else the ampacity reduction factor of Note 4 of Tables 310-69 through 310-84 shall be applied.

3. For SI units: one inch = 25.4 millimeters; one foot = 305 millimeters.

LEGEND

- [Backfill icon] Backfill (earth or concrete)
- [Electrical duct icon] Electrical duct
- [Cable icon] Cable or cables

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Conductors for General Wiring

Table 310-16

Allowable Ampacities of Insulated Conductors Rated 0 through 2000 Volts, 60° to 90°C (140° to 194°F). Not More Than Three Current-Carrying Conductors in Raceway or Cable or Earth (Directly Buried). Based on Ambient Temperature of 30°C (86°F)

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR						SIZE AWG/ kcmil
	60°C (140°F) TYPES TW†, UF†	75°C (167°F) TYPES FEPW†, RHT RHW†, THHW†, THW†, THWN†, XHHW†, USE†, ZW†	90°C (194°F) TYPES TBS, SA, SIS, FEPT, FEPBT, MI, RHHT, RHW-2, THHN†, THHW†, THW-2†, THWN-2†, USE-2, XHH, XHHW†, XHHW-2, ZW-2	60°C (140°F) TYPES TW†, UF†	75°C (167°F) TYPES RHT, RHWT, THHW†, THW†, THWN†, USE†	90°C (194°F) TYPES TBS, SA, SIS, THHN†, THHW†, THW-2, THWN-2, RHHT, RHW-2, USE-2, XHH XHHW, XHHW-2, ZW-2	
COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM			
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14	20†	20†	25†	—	—	—	—
12	25†	25†	30†	20†	20†	25†	12
10	30	35†	40†	25	30†	35†	10
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

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Conductors for General Wiring

Table 310-16 (continued)

AMBIENT TEMP. °C	CORRECTION FACTORS FOR AMBIENT TEMPERATURES OTHER THAN 30°C (86°F), MULTIPLY THE ALLOWABLE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.						AMBIENT TEMP. °F
	21-25	26-30	31-35	36-40	41-45	46-50	
21-25	1.08	1.05	1.04	1.08	1.05	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	78-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	123-131
56-60	—	0.58	0.71	—	0.58	0.71	132-140
61-70	—	0.33	0.58	—	0.33	0.58	141-158
71-80	—	—	0.41	—	—	0.41	159-176

^t Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12, and 30 amperes for No. 10 copper; or 15 amperes for No. 12 and 25 amperes for No. 10 aluminum and copper-clad aluminum after any correction factors for ambient temperatures and number of conductors have been applied.

Adjustment Factors

More than Three Current-Carrying Conductors in a Raceway or Cable. Where the number of current-carrying conductors in a raceway or cable exceeds three, the allowable ampacities shall be reduced as shown in the table below:

NUMBER OF CURRENT-CARRYING CONDUCTORS	PERCENT OF VALUES IN TABLES AS ADJUSTED FOR AMBIENT TEMPERATURE IF NECESSARY
4 through 6	80
7 through 9	70
10 through 20	50
21 through 31	45
31 through 40	40
41 and above	35

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Conductors for General Wiring

Table 310-17

Allowable Ampacities of Single Insulated Conductors, Rated 0 through 2000 Volts in Free Air Based on Ambient Air Temperature of 30°C (86°F)

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR						SIZE AWG/ kcmil
	60°C (140°F) TYPES TW†, UF†	75°C (167°F) TYPES FEPWT, RHT RHW†, THHW†, THWT, THWN†, XHHW†, ZWT	90°C (194°F) TYPES TBS, SA, SIS, FEPT, FEPBT, MI, RHHT, RHW-2, THHN1†, THHW†, THW-2†, THWN-2†, USE-2, XHH, XHHW1, XHHW-2, ZW-2	60°C (140°F) TYPES TW†, UF†	75°C (167°F) TYPES RHT, RHWT, THHW†, THWT, THWN†, XHHW†	90°C (194°F) TYPES TBS, SA, SIS, THHN1, THHW1†, THW-2, THWN-2, RHHT, RWH-2, USE-2, XHH, XHHW1, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18	—	—	18	—	—	—	—
16	—	—	24	—	—	—	—
14	25†	30†	35†	—	—	—	—
12	30†	35†	40†	25†	30†	35†	12
10	40†	50†	55†	35	40†	40†	10
8	60	70	80	45	55	60	8
6	80	95	105	60	75	80	6
4	105	125	140	80	100	110	4
3	120	145	165	95	115	130	3
2	140	170	190	110	135	150	2
1	165	195	220	130	155	175	1
1/0	195	230	260	150	180	205	1/0
2/0	225	265	300	175	210	235	2/0
3/0	260	310	350	200	240	275	3/0
4/0	300	360	405	235	280	315	4/0
250	340	405	455	265	315	355	250
300	375	445	505	290	350	395	300
350	420	505	570	330	395	445	350
400	455	545	615	355	425	480	400
500	515	620	700	405	485	545	500
600	575	690	780	455	540	615	600
700	630	755	855	500	595	675	700
750	655	785	885	515	620	700	750
800	680	815	920	535	645	725	800
900	730	870	985	580	700	785	900
1000	780	935	1055	625	750	845	1000
1250	890	1065	1200	710	855	960	1250
1500	980	1175	1325	795	950	1075	1500
1750	1070	1280	1445	875	1050	1185	1750
2000	1155	1385	1560	960	1150	1335	2000
CORRECTION FACTORS							
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 30°C (86°F), MULTIPLY THE ALLOWABLE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.						AMBIENT TEMP. °F
21-25	1.08	1.05	1.04	1.08	1.05	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	78-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	123-131
56-60	—	0.58	0.71	—	0.58	0.71	132-140
61-70	—	0.33	0.58	—	0.33	0.58	141-158
71-80	—	—	0.41	—	—	0.41	159-176

† Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12, and 30 amperes for No. 10 copper; or 15 amperes for No. 12 and 25 amperes for No. 10 aluminum and copper-clad aluminum.

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Conductors for General Wiring

Table 310-20

Ampacities of Two or Three Single Insulated Conductors, Rated 0 through 2000 Volts Supported on a Messenger, Based on Ambient Air Temperature of 40°C (104°F)

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR				SIZE AWG/ kcmil
	75°C (167°F) TYPES RH, RHW THHN, THW THWN, XHHW, ZW	90°C (194°F) TYPES THHN, THHW THW-2, THWN-2, RHH, RWH-2, USE-2, XHHW, XHHW-2, ZW-2	75°C (167°F) TYPES RH, RHW THW, THWN, THHW, XHHW	90°C (194°F) TYPES THHN, THHW RHH, XHHW RHW-2, XHHW-2, THW-2, THWN-2, USE-2, ZW-2	
	57	66	44	51	
8	57	66	44	51	8
6	76	89	59	69	6
4	101	117	78	91	4
3	118	138	92	107	3
2	135	158	106	123	2
1	158	185	123	144	1
1/0	183	214	143	167	1/0
2/0	212	247	165	193	2/0
3/0	245	287	192	224	3/0
4/0	287	335	224	262	4/0
250	320	374	251	292	250
300	359	419	282	328	300
350	397	464	312	364	350
400	430	503	339	395	400
500	496	580	392	458	500
600	553	647	440	514	600
700	610	714	488	570	700
750	638	747	512	598	750
800	660	773	532	622	800
900	704	826	572	669	900
1000	748	879	612	716	1000
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 40°C (104°F), MULTIPLY THE AMPACITIES SHOW ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.				AMBIENT TEMP °F
21-25	1.20	1.14	1.20	1.14	70-77
26-30	1.13	1.10	1.13	1.10	79-86
31-35	1.07	1.05	1.07	1.05	88-95
36-40	1.00	1.00	1.00	1.00	97-104
41-45	0.93	0.95	0.93	0.95	106-113
46-50	0.85	0.89	0.85	0.89	115-122
51-55	0.76	0.84	0.76	0.84	124-131
56-60	0.65	0.77	0.65	0.77	133-140
61-70	0.38	0.63	0.38	0.63	142-158
71-80	—	0.45	—	0.45	160-176

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Conductors for General Wiring

Table 310-67

Ampacities of Insulated Single Copper Conductor Cables Triplexed in Air Based on Conductor Temperature of 90°C (194°F) and 105°C (221°F) and Ambient Air Temperature of 40°C (104°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
8	65	74	—	—
6	90	99	100	110
4	120	130	130	140
2	160	175	170	195
1	185	205	195	225
1/0	215	240	225	255
2/0	250	275	260	295
3/0	290	320	300	340
4/0	335	375	345	390
250	375	415	380	430
350	465	515	470	525
500	580	645	580	650
750	750	835	730	820
1000	880	980	850	950

Table 310-69

Ampacities of Insulated Single Copper Conductor Isolated in Air Based on Conductor Temperature of 90°C (194°F) and 105°C (221°F) and Ambient Air Temperature of 40°C (104°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR					
	2001-5000 VOLTS AMPACITY		5001-15,000 VOLTS AMPACITY		15,001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
8	83	93	—	—	—	—
6	110	120	110	125	—	—
4	145	160	150	165	—	—
2	190	215	195	215	—	—
1	225	250	225	250	225	250
1/0	260	290	260	290	260	290
2/0	300	330	300	335	300	330
3/0	345	385	345	385	345	380
4/0	400	445	400	445	395	445
250	445	495	445	495	440	490
350	550	615	550	610	545	605
500	695	775	685	765	680	755
750	900	1000	885	990	870	970
1000	1075	1200	1060	1185	1040	1160
1250	1230	1370	1210	1350	1185	1320
1500	1365	1525	1345	1500	1315	1465
1750	1495	1665	1470	1640	1430	1595
2000	1605	1790	1575	1755	1535	1710

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Conductors for General Wiring

Table 310-71

Ampacities of an Insulated Three-Conductor Copper Cable Isolated in Air Based on Conductor Temperature of 90°C (194°F) and 105°C (221°F) and Ambient Air Temperature of 40°C (104°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
8	59	66	—	—
6	79	88	93	105
4	105	115	120	135
2	140	154	165	185
1	160	180	185	210
1/0	185	205	215	240
2/0	215	240	245	275
3/0	250	280	285	315
4/0	285	320	325	360
250	320	355	360	400
350	395	440	435	490
500	485	545	535	600
750	615	685	670	745
1000	705	790	770	860

Table 310-73

Ampacities of an Insulated Triplexed or Three Single Conductor Copper Cables in Isolated Conduit in Air Based on Conductor Temperature of 90°C (194°F) and 105°C (221°F) and Ambient Air Temperature of 40°C (104°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
8	55	61	—	—
6	75	84	83	93
4	97	110	110	120
2	130	145	150	165
1	155	175	170	190
1/0	180	200	195	215
2/0	205	225	225	255
3/0	240	270	260	290
4/0	280	305	295	330
250	315	355	330	365
350	385	430	395	440
500	475	530	480	535
750	600	665	585	655
1000	690	770	675	755

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Conductors for General Wiring

Table 310-75

Ampacities of an Insulated Three-Conductor Copper Cable in Isolated Conduit in Air Based on Conductor Temperature of 90°C (194°F) and 105°C (221°F) and Ambient Air Temperature of 40°C (104°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
8	52	58	—	—
6	69	77	83	92
4	91	100	105	120
2	125	135	145	165
1	140	155	165	185
1/0	165	185	195	215
2/0	190	210	220	245
3/0	220	245	250	280
4/0	255	285	290	320
250	280	315	315	350
350	350	390	385	430
500	425	475	470	525
750	525	585	570	635
1000	590	660	650	725

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Conductors for General Wiring

Table 310-77

Ampacities of Three Single Insulated Copper Conductors in Underground Electrical Ducts (Three Conductors per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement per Figure 310-1, 100 Percent Load Factor Thermal Resistance (RHO) of 90, Conductor Temperature of 90°C (194°F) and 105°C (221°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
One Circuit (See Figure 310-1, Detail 1)				
8	64	69	—	—
6	85	92	90	97
4	110	120	115	125
2	145	155	155	165
1	170	180	175	185
1/0	195	210	200	215
2/0	220	235	230	245
3/0	250	270	260	275
4/0	290	310	295	315
250	320	345	325	345
350	385	415	390	415
500	470	505	465	500
750	585	630	565	610
1000	670	720	640	690
Three Circuit (See Figure 310-1, Detail 2)				
8	56	60	—	—
6	73	79	77	83
4	95	100	99	105
2	125	130	130	135
1	140	150	145	155
1/0	160	175	165	175
2/0	185	195	185	200
3/0	210	225	210	225
4/0	235	255	240	255
250	260	280	260	280
350	315	335	310	330
500	375	405	370	395
750	460	495	440	475
1000	525	565	495	535
Six Circuit (See Figure 310-1, Detail 3)				
8	48	52	—	—
6	62	67	64	68
4	80	86	82	88
2	105	110	105	115
1	115	125	120	125
1/0	135	145	135	145
2/0	150	160	150	165
3/0	170	185	170	185
4/0	195	210	190	205
250	210	225	210	225
350	250	270	245	265
500	300	325	290	310
750	365	395	350	375
1000	410	445	390	415

For SI units: 1 in. = 25.4 mm.

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Conductors for General Wiring

Table 310-79

Ampacities of Three Single Insulated Copper Conductors Cabled within an Overall Covering (three-Conductor Cable) in Underground Electrical Ducts (One Cable per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F) Electrical Duct Arrangement per Figure 310-1, 100 Percent Load Factor, Thermal Resistance (RHO) of 90 Conductor Temperature of 90°C (194°F) and 105°C (221°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
One Circuit (See Figure 310-1, Detail 1)				
8	59	64	—	—
6	78	84	88	95
4	100	110	115	125
2	135	145	150	160
1	155	165	170	185
1/0	175	190	195	210
2/0	200	220	220	235
3/0	230	250	250	270
4/0	265	285	285	305
250	290	315	310	335
350	355	380	375	400
500	430	460	450	485
750	530	570	545	585
1000	600	645	615	660
Three Circuit (See Figure 310-1, Detail 2)				
8	53	57	—	—
6	69	74	75	81
4	89	96	97	105
2	115	125	125	135
1	135	145	140	155
1/0	150	165	160	175
2/0	170	185	185	195
3/0	195	210	205	220
4/0	225	240	230	250
250	245	265	255	270
350	295	315	305	325
500	355	380	360	385
750	430	465	430	465
1000	485	520	485	515
Six Circuit (See Figure 310-1, Detail 3)				
8	46	50	—	—
6	60	65	63	68
4	77	83	81	87
2	98	105	105	110
1	110	120	115	125
1/0	125	135	130	145
2/0	145	155	150	160
3/0	165	175	170	180
4/0	185	200	190	200
250	200	220	205	220
350	240	270	245	275
500	290	310	290	305
750	350	375	340	365
1000	390	420	380	405

For SI units: 1 in. = 25.4 mm.

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Conductors for General Wiring

Table 310-81

Ampacities of Single Insulated Copper Conductors Directly Buried in Earth Based on Ambient Earth Temperature of 20°C (68°F), Arrangement per Figure 310-1, 100 Percent Load Factor Thermal Resistance (RHO) of 90, Conductor Temperature of 90°C (194°F) and 105°C (221°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	TYPE MV-105
One Circuit — 3 Conductors (See Figure 310-1, Detail 9)				
8	110	115	—	—
6	140	150	130	140
4	180	195	170	180
2	230	250	210	225
1	260	280	240	260
1/0	295	320	275	295
2/0	335	365	310	335
3/0	385	415	355	380
4/0	435	465	405	435
250	470	510	440	475
350	570	615	535	575
500	690	745	650	700
750	845	910	805	865
1000	980	1055	930	1005
Two Circuits — 6 Conductors (See Figure 310-1, Detail 10)				
8	100	110	—	—
6	130	140	120	130
4	165	180	160	170
2	215	230	195	210
1	240	260	225	240
1/0	275	295	255	275
2/0	310	335	290	315
3/0	355	380	330	355
4/0	400	430	375	405
250	435	470	410	440
350	520	560	495	530
500	630	680	600	645
750	775	835	740	795
1000	890	960	855	920

For SI units: 1 in. = 25.4 mm.

Dimensions and weights are nominal; subject to industry tolerance.

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Conductors for General Wiring

Table 310-83

Ampacities of Three Insulated Copper Conductors Cabled within an Overall Covering (Three-Conductor Cable)

Directly Buried in Earth, Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement per Figure 310-1, 100 Percent Load Factor, Thermal Resistance (RHO) of 90, Conductor Temperature of 90°C (194°F) and 105°C (221°F)

CONDUCTOR SIZE AWG/kcmil	TEMPERATURE RATING OF CONDUCTOR			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F)	105°C (221°F)	90°C (194°F)	105°C (221°F)
	TYPE MV-90	TYPE MV-105	TYPE MV-90	MV-105
One Circuit— (See Figure 310-1, Detail 5)				
8	85	89	—	—
6	105	115	115	120
4	135	150	145	155
2	180	190	185	200
1	200	215	210	225
1/0	230	245	240	255
2/0	260	280	270	290
3/0	295	320	305	330
4/0	335	360	350	375
250	365	395	380	410
350	440	475	460	495
500	530	570	550	590
750	650	700	665	720
1000	730	785	750	810
Two Circuits— (See Figure 310-1, Detail 10)				
8	80	84	—	—
6	100	105	105	115
4	130	140	135	145
2	165	180	170	185
1	185	200	195	210
1/0	215	230	220	235
2/0	240	260	250	270
3/0	275	295	280	305
4/0	310	335	320	345
250	340	365	350	375
350	410	440	420	450
500	490	525	500	535
750	595	640	605	650
1000	665	715	675	730

For SI units: 1 in. = 25.4 mm.

Dimensions and weights are nominal; subject to industry tolerance.

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Conductors for General Wiring

Table 310-85

Ampacities of Three Triplexed Single Insulated Copper Conductors Directly Buried in Earth Based on Ambient Earth Temperature of 20°C (68°F), Arrangement per Figure 310-60, 100 Percent Load Factor, Thermal Resistance (RHO) of 90, Conductor Temperatures of 90°C (194°F) and 105°C (221°F).

CONDUCTOR SIZE (AWG OR kcmil)	TEMPERATURE RATING OF CONDUCTOR (SEE TABLE 310-61)			
	2001-5000 VOLTS AMPACITY		5001-35,000 VOLTS AMPACITY	
	90°C (194°F) TYPE MV-90	105°C (221°F) TYPE MV-105	90°C (194°F) TYPE MV-90	105°C (221°F) TYPE MV-105
One Circuit, Three Conductors (See Figure 310-60, Detail 7)				
8	90	95	—	—
6	120	130	115	120
4	150	165	150	160
2	195	205	190	205
1	225	240	215	230
1/0	255	270	245	260
2/0	290	310	275	295
3/0	330	360	315	340
4/0	375	405	360	385
250	410	445	390	410
350	490	580	470	505
500	590	635	565	605
750	725	780	685	740
1000	825	885	770	830
Two Circuits, Six Conductors (See Figure 310-60, Detail 8)				
8	85	90	—	—
6	110	115	105	115
4	140	150	140	150
2	180	195	175	190
1	205	220	200	215
1/0	235	250	225	240
2/0	265	285	255	275
3/0	300	320	290	315
4/0	340	365	325	350
250	370	395	355	380
350	445	480	425	455
500	535	575	510	545
750	650	700	615	660
1000	740	795	690	745

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Conductors for General Wiring

Table B-310-1

Ampacities of Two or Three Insulated Conductors, Rated 0 through 2000 Volts within an Overall Covering (Multiconductor Cable), in Raceway, in Free Air, Based on Ambient Air Temperature of 30°C (86°F)

SIZE	TEMPERATURE RATING OF CONDUCTOR						SIZE
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
AWG/ kcmil	TYPES TW, UF	TYPES RH, RHW THHW, THW THWN, XHHW, ZW	TYPES THHN, THHW, THW-2, THWN-2, RHH, RWH-2, USE-2, XHHW XHHW-2, ZW-2	TYPES TW	TYPES RH, RHW, THHW, THW, THWN, XHHW	TYPES THHN, THHW, THW-2, THWN-2, RHHT, RWH-2, USE-2, XHHW, XHHW-2, ZW-2	AWG/ kcmil
COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM			
14	16†	18†	21†	—	—	—	—
12	20†	24†	27†	16†	18†	21†	12
10	27†	33†	36†	21†	25†	28†	10
8	36	43	48	28	33	37	8
6	48	58	65	38	45	51	6
4	66	79	89	51	61	69	4
3	76	90	102	59	70	79	3
2	88	105	119	69	83	93	2
1	102	121	137	80	95	106	1
1/0	121	145	163	94	113	127	1/0
2/0	138	166	186	108	129	146	2/0
3/0	158	189	214	124	147	167	3/0
4/0	187	223	253	147	176	197	4/0
250	205	245	276	160	192	217	250
300	234	281	317	185	221	250	300
350	255	305	345	202	242	273	350
400	274	328	371	218	261	295	400
500	315	378	427	254	303	342	500
600	343	413	468	279	335	378	600
700	376	452	514	310	371	420	700
750	387	466	529	321	384	435	750
800	397	479	543	331	397	450	800
900	415	500	570	350	421	477	900
1000	448	542	617	382	460	521	1000
CORRECTION FACTORS							
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 30°C (86°F), MULTIPLY THE ALLOWABLE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.						AMBIENT TEMP. °F
21-25	1.08	1.05	1.04	1.08	1.05	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	79-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	88-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	97-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	106-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	115-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	124-131
56-60	—	0.58	0.71	—	0.58	0.71	133-140
61-70	—	0.33	0.58	—	0.33	0.58	142-158
71-80	—	—	0.41	—	—	0.41	160-176

† Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12, and 30 amperes for No. 10 copper; or 15 amperes for No. 12 and 25 amperes for No. 10 aluminum and copper-clad aluminum.

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Conductors for General Wiring

Table B-310-3

Ampacities of Multiconductor Cables with Not More than Three Insulated Conductors, Rated 0 through 2000 Volts in Free Air Based on Ambient Air Temperature of 40°C (104°F) (For TC, MC, MI, UF, and USE Cables)

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR								SIZE AWG/ kcmil									
	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)										
COPPER									ALUMINUM OR COPPER-CLAD ALUMINUM									
18				11†					18									
16				16†					16									
14	18†	21†	24†	25†					14									
12	21†	28†	30†	32†	18†	21†	24†	25†	12									
10	28†	36†	41†	43†	21†	28†	30†	32†	10									
8	39	50	56	59	30	39	44	46	8									
6	52	68	75	79	41	53	59	61	6									
4	69	89	100	104	54	70	78	81	4									
3	81	104	116	121	63	81	91	95	3									
2	92	118	132	138	72	92	103	108	2									
1	107	138	154	161	84	108	120	126	1									
1/0	124	160	178	186	97	125	139	145	1/0									
2/0	143	184	206	215	111	144	160	168	2/0									
3/0	165	213	238	249	129	166	185	194	3/0									
4/0	190	245	274	287	149	192	214	224	4/0									
250	212	274	305	320	166	214	239	250	250									
300	237	306	341	357	186	240	268	280	300									
350	261	337	377	394	205	265	296	309	350									
400	281	363	406	425	222	287	317	334	400									
500	321	416	465	487	255	330	368	385	500									
600	354	459	513	538	284	368	410	429	600									
700	387	502	562	589	306	405	462	473	700									
750	404	523	586	615	328	424	473	495	750									
800	415	539	604	633	339	439	490	513	800									
900	438	570	639	670	362	469	514	548	900									
1000	461	601	674	707	385	499	558	584	1000									
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 30°C (86°F), MULTIPLY THE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.								AMBIENT TEMP. °F									
21-25	1.32	1.20	1.15	1.14	1.32	1.20	1.15	1.14	70-77									
26-30	1.22	1.13	1.11	1.10	1.22	1.13	1.11	1.10	79-86									
31-35	1.12	1.07	1.05	1.05	1.12	1.07	1.05	1.05	88-95									
36-40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	97-104									
41-45	0.87	0.93	0.94	0.95	0.87	0.93	0.94	0.95	106-113									
46-50	0.71	0.85	0.88	0.89	0.71	0.85	0.88	0.89	115-122									
51-55	0.50	0.76	0.82	0.84	0.50	0.76	0.82	0.84	124-131									
56-60	—	0.65	0.75	0.77	—	0.65	0.75	0.77	133-140									
61-70	—	0.38	0.58	0.63	—	0.38	0.58	0.63	142-158									
71-80	—	—	0.33	0.44	—	—	0.33	0.44	160-176									

† Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12, and 30 amperes for No. 10 copper; or 15 amperes for No. 12 and 25 amperes for No. 10 aluminum and copper-clad aluminum.

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Conductors for General Wiring

Table B-310-8

Ampacities of Two or Three Insulated Conductors, Rated 0 through 2000 Volts, Cabled within an Overall (Two- or Three-Conductor) Covering, Directly Buried in Earth, Based on Ambient Air Temperature of 20°C (68°F) Arrangement per Figure B-310-2, 100 Percent Load Factor, Thermal Resistance (Rho) of 90.

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR								SIZE AWG/ kcmil	
	1 CABLE (FIG. B310-2, DETAIL 5)		2 CABLES FIG. B310-2, DETAIL 6)		1 CABLE (FIG. B310-2, DETAIL 5)		2 CABLES (FIG. B310-2, DETAIL 6)			
	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)		
	TYPES									
UF	RHW, THHW, THW, THWN, XHHW, USE	UF	RHW THHW, THW, THWN, SHHW, USE	UF	RHW, THHW, THW, THWN, XHHW, USE	UF	RHW, THHW, THW, THWN, XHHW, USE			
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM					
8	64	75	60	70	51	59	47	55	8	
6	85	100	81	95	68	75	60	70	6	
4	107	125	100	117	83	97	78	91	4	
2	137	161	128	150	107	126	110	117	2	
1	155	182	145	170	121	142	113	132	1	
1/0	177	208	165	193	138	162	129	151	1/0	
2/0	201	236	188	220	157	184	146	171	2/0	
3/0	229	269	213	250	179	210	166	195	3/0	
4/0	259	304	241	282	203	238	188	220	4/0	
250		333		308		261		241	250	
350		401		370		315		290	350	
500		481		442		381		350	500	
750		585		535		473		433	750	
1000		657		600		545		497	1000	
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 20°C (68°F), MULTIPLY THE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.								AMBIENT TEMP °F	
6-10	1.12	1.09	1.12	1.09	1.12	1.09	1.12	1.09	43-50	
11-15	1.06	1.04	1.04	1.04	1.06	1.04	1.06	1.04	52-59	
16-20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	61-68	
21-25	0.94	0.95	0.94	0.95	0.94	0.95	0.94	0.95	70-77	
26-30	0.87	0.90	0.87	0.90	0.87	0.90	0.87	0.90	79-86	

For ampacities of UF cable in underground electrical ducts, multiply the ampacities shown in the table by 0.74.

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Conductors for General Wiring

Table B-310-9

Ampacities of Three Triplexed Single Insulated Conductors, Rated 0 through 2000 Volts, Directly Buried in Earth Based on Ambient Earth Temperature of 20°C (68°F), Arrangement per Figure B-310-2, 100 Percent Load Factor, Thermal Resistance (Rho) of 90.

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR								SIZE AWG/ kcmil	
	SEE (FIG. B-310-2, DETAIL 7)		SEE (FIG. B-310-2, DETAIL 8)		SEE (FIG. B-310-2, DETAIL 7)		SEE (FIG. B-310-2, DETAIL 8)			
	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)		
	TYPES									
UF		USE	UF	USE	UF	USE	UF	USE		
COPPER					ALUMINUM OR COPPER-CLAD ALUMINUM					
8	72	84	66	77	55	65	51	60	8	
6	91	107	84	99	72	84	66	77	6	
4	119	139	109	128	92	108	85	100	4	
2	153	179	140	164	119	139	109	128	2	
1	173	203	159	186	135	158	124	145	1	
1/0	197	231	181	212	154	180	141	165	1/0	
2/0	223	262	205	240	175	205	159	187	2/0	
3/0	254	298	232	272	199	233	181	212	3/0	
4/0	289	339	263	308	226	265	206	241	4/0	
250		370		336		289		263	250	
350		445		403		349		316	350	
500		536		483		424		382	500	
750		654		587		525		471	750	
1000		744		665		608		544	1000	
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 20°C (68°F), MULTIPLY THE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.								AMBIENT TEMP °F	
6-10	1.12	1.09	1.12	1.09	1.12	1.09	1.12	1.09	43-50	
11-15	1.06	1.04	1.06	1.04	1.06	1.04	1.06	1.04	52-59	
16-20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	61-68	
21-25	0.94	0.95	0.94	0.95	0.94	0.95	0.94	0.95	70-77	
26-30	0.87	0.90	0.87	0.90	0.87	0.90	0.87	0.90	79-86	

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Conductors for General Wiring

Table B-310-10

Ampacities of Three Single Insulated Conductors, Rated 0 through 2000 Volts, Directly Buried in Earth Based on Ambient Earth Temperature of 20°C (68°F) Arrangement per Figure B-310-2, 100 Percent Load Factor. Thermal Resistance (Rho) of 90.

SIZE AWG/ kcmil	TEMPERATURE RATING OF CONDUCTOR								SIZE AWG/ kcmil	
	DETAIL 9		DETAIL 10		DETAIL 9		DETAIL 10			
	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)		
	TYPES				TYPES					
	UF	USE	UF	USE	UF	USE	UF	USE		
COPPER										
8	84	98	78	92	66	77	61	72	8	
6	107	126	101	118	84	98	78	92	6	
4	139	163	130	152	108	127	101	118	4	
2	178	209	165	194	139	163	129	151	2	
1	201	236	187	219	157	184	146	171	1	
1/0	230	270	212	249	179	210	165	194	1/0	
2/0	261	306	241	283	204	239	188	220	2/0	
3/0	297	348	274	321	232	272	213	250	3/0	
4/0	336	394	309	362	262	307	241	283	4/0	
250		429		394		335		308	250	
350		516		474		403		370	350	
500		626		572		490		448	500	
750		767		700		605		552	750	
1000		887		808		706		642	1000	
1250		979		891		787		716	1250	
1500		1063		965		862		783	1500	
1750		1133		1027		930		843	1750	
2000		1195		1082		990		897	2000	
AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 20°C (68°F), MULTIPLY THE AMPACITIES SHOWN ABOVE BY THE APPROPRIATE FACTOR SHOWN BELOW.								AMBIENT TEMP. °F	
6-10	1.12	1.09	1.12	1.09	1.12	1.09	1.12	1.09	43-50	
11-15	1.06	1.04	1.06	1.04	1.06	1.04	1.06	1.04	52-59	
16-20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	61-68	
21-25	.94	.95	.94	.95	.94	.95	.94	.95	70-77	
26-30	.87	.90	.87	.90	.87	.90	.87	.90	79-86	

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